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Knowledge levels of graduate and trainee dentists on antibiotic use in endodontics

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ABSTRACT

Aims: The aim of this study was to compare and evaluate the level of knowledge of dentists and dental students about the rational use of antibiotics (RUA), their clinical approaches when prescribing antibiotics, and student and graduate dentists. Rational use of medicines means that patients take their medicines according to their clinical needs, in appropriate doses, for sufficient time, and at the lowest cost to themselves and society. The RUA is very important in the treatment and prevention of bacterial infections.

Methods: The questionnaire, which was prepared on Google Forms for all graduate and trainee dentists in Turkey that we could reach and included questions about RUA and antibiotic use in dentists, was distributed to approximately 400 people, and 331 people returned the questionnaire.

Results: Of the respondents, 52.3% were dental students, and the remaining 47.7% were dental graduates. 94.8% of the participants reported that they received information about RUA from the faculty, followed by scientific publications, the internet and social media, the Ministry of Health, relatives, spouses, and friends, professional associations, and newspapers. The majority of participants, 303 people, answered the question, 'Can inappropriate use of antibiotics increase antimicrobial resistance? The majority of participants answered yes, while the remaining 18 answered no. The majority of participants, 62.1%, thought that antibiotics were prescribed more than necessary. Only 35% of participants (110 people) correctly answered the question about antibiotics that are not suitable for use during pregnancy and breastfeeding.

Conclusion: According to the results of our study, dentists have an important role to play in ensuring the RUA. Dentists should be regularly trained with updated curricula.

Keywords: Rational antibiotic use, dentistry, dental trainees

INTRODUCTION

Rational use of antibiotics (RUA) means prescribing drugs in accordance with the clinical needs of patients, in appropriate doses, for an adequate duration, and at the lowest cost to themselves and society.[1,2] RUA has a very important place in the treatment and prevention of bacterial infections.[3,4] RUA is necessary to prevent important problems such as the development of antibiotic resistance. Antibiotic resistance has become one of the biggest obstacles to the successful treatment of infections. WHO (World Health Organization) and various national and international organizations have made emergency action plans to prevent the development of resistant bacterial strains and limit their spread.[5,6] There are various reasons for this increasing problem, but the most important is the misuse or overuse of antibiotics in both human and veterinary medicine and animal husbandry.[7] Awareness-raising trainings should be organized for both prescribing physicians and the public in order to limit and improve the unnecessary use or misuse of this group of drugs. Antibiotics, which are also widely used in dental practices, are among the most commonly used drugs in Turkey.[8-10] As a result of the misuse of antibiotics, both adverse effects on patients and harmful effects, such as the emergence of harmful and resistant bacterial strains in the environment, occur.

The more they are used, the more resistance develops and spreads. As with medical and veterinary practitioners, new initiatives have increased in dentistry, a field of serious importance for rational antibiotic use. Dentists constitute a significant portion of physicians prescribing antibiotics, but it has been shown that the therapeutic decisions of dentists

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when prescribing antibiotics are not always correct.[11,12] It is known that there are more than 700 microorganisms in our oral microflora.[13,14] This flora consists of viruses, gram-positive and gram-negative aerobic and anaerobic bacteria, and a small number of yeast fungi. These flora members are mostly non-pathogenic, but pathogenic species may increase and lead to dental infections due to reasons such as poor oral hygiene, nutrition, host immune response, and aging.[15-17] Although antibiotics are widely used in the treatment of dental infections, they actually have a limited indication for use.[18] Instead of using antibiotics, dental infections are mostly treated with root canal treatments, tooth extraction, surgical drainage, and scaling or smoothing of the tooth root surface. Systemic antibiotic use is required only in cases where prophylaxis is required, abscesses cannot be drained, the effect of local anesthesia is insufficient, fever, trismus, cellulitis, osteomyelitis, and lymphadenopathy.[15] When indicated, RUA includes selecting the right antibiotic at the appropriate dose and duration, considering the cost of treatment, prescribing it in the right format, providing adequate and understandable information to the patient, using the antibiotic correctly, and evaluating the results of treatment. Physicians have a very important role in this process. They should diagnose the patient correctly and make sure that the above-mentioned requirements for antibiotic use are met. Irrational use of antibiotics (IUA) leads to many irreparable problems, such as increased bacterial resistance and low treatment success rates. Antibiotics are medicines that need to be used with caution due to increasing bacterial resistance, high costs, and the decline in new antibiotic discoveries. RUA means using the appropriate antibiotic at the appropriate time and dose at the lowest cost. Dentists frequently encounter situations such as dental-gingival infections and endocarditis prophylaxis. Therefore, they work in a field where antibiotics are frequently used. The aim of this study was to compare and evaluate the level of knowledge of dentists and dental students about RUA, their clinical approaches when prescribing antibiotics, their tendency to prescribe antibiotics in pulpal infections for which antibiotics are not indicated, and student and graduate dentists.

METHODS

The study was carried out with the permission of Van Yüzüncüyıl University Clinical Researches Ethics Committee (Date: 01.09.2022, Decision No: 01). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

The questionnaire, which was prepared via Google Forms for all accessible graduate and trainee dentists in Turkey and included questions about RUA and the use of antibiotics in dentists, was distributed to approximately 400 people, and 331 people returned the questionnaire. Only participants who read the consent form and selected the "I agree to participate in the study" tab were included in the study. The questions do not include personal information. Some of the questions included demographic data, some included data on the issues to be considered when prescribing antibiotics, and the questionnaire also included questions to assess the participant's level of knowledge and interest in RUA. The responses of graduate and trainee participants were compared and evaluated.

Inclusion Criteria

Students in their 4th or 5th year of internship at a university in Turkey, dentists who graduated from the faculty of dentistry, and those who agreed to fill out the online survey.

Exclusion Criteria

No other occupational group is included, and those who did not complete the questionnaire completely are not included.

Obtaining Data

In our study, all data was available in the Excel system in Google Forms. All data were statistically evaluated.

Statistical Evaluation Methods

NCSS (Number Cruncher Statistical System) 2020 Statistical Software (NCSS LLC, Kaysville, Utah, USA) was used for statistical analyses while evaluating the findings obtained in the study. While evaluating the study data, quantitative variables were shown with mean, standard deviation, median, min, and max values, and qualitative variables were shown with descriptive statistical methods such as frequency and percentage. Shapiro-Wilks test and box plot graphs were used to evaluate the conformity of the data to the normal distribution. Chi-Square test, Fisher's exact test, and Fisher Freeman Halton test were used to compare qualitative data. The results were evaluated at the 95% confidence interval, and significance was evaluated at the p 0.05 level.

RESULTS

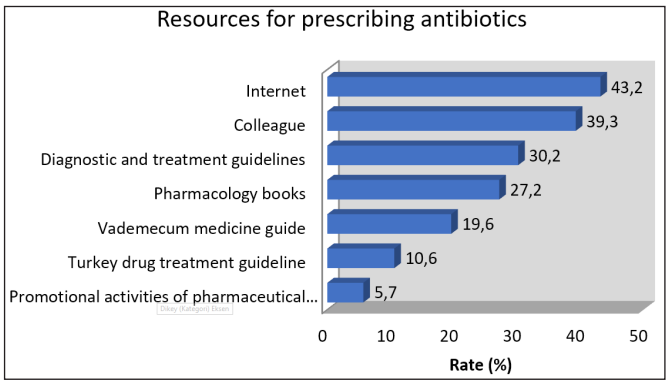
The questionnaire was distributed to a total of 400 people via the WhatsApp application, e-mail groups, and professional organizations' chambers. The questionnaire was completed by 331 volunteers. It was observed that almost every geographical region of our country participated in the study (Table 1). Part of the questionnaire consisted of general and demographic questions; part of the questionnaire consisted of questions about RUA; and part of the questionnaire consisted of questions evaluating information about endodontic infections, which are the most common reason for antibiotic use in dentistry and one of the most common reasons for antibiotic prescription. Of the participants, 52.3% were trainee

dentists, and the remaining 47.7% were graduate dentists. The numerical distribution of graduated dentists was close to each other. Table 1 also shows the specialty, type of workplace, professional status, and average age.

Table 1. Distribution of descriptive characteristics

	n (%)
Gender	
Female	174 (52.6)
Male	157 (47.4)
Age	
<25 years	174 (52.6)
25-30 years	61 (18.4)
30-45 years	87 (26.3)
>45 years	9 (2.7)
Professional status	
Academician	41 (12.4)
Dental resident	33 (10.0)
Dentist	50 (15.1)
Graduate specialist/PhD dentist	34 (10.3)
Trainee	173 (52.3)
Specialization	
Oral, and maxillofacial surgery	21 (6.5)
Endodontics	46 (14.3)
General dentist	49 (15.3)
Oral pathologist	1 (0.3)
Orthodontist	2 (0.6)
Pedodontics	7 (2.2)
Periodontology	8 (2.5)
Prosthetic dentist	8 (2.5)
Restorative	6 (1.9)
Number of years of practice	
<5 years	46 (29.9)
5-10 years	34 (22.1)
10-20 years	63 (40.9)
>20 years	11 (7.1)
Region of residence	
Mediterranean Region	22 (6.6)
Eastern Anatolia	39 (11.8)
Aegean Region	12 (3.6)
Southeastern Anatolia	53 (16)
Central Anatolia Region	19 (5.7)
Black Sea Region	11 (3.3)
Marmara Region	175 (52.9)
What type of workplace he/she works in	
State Hospital	32 (16.5)
Private practice	25 (12.9)
Policlinic	40 (20.6)
University	97 (50)

When question 2 of the questionnaire, which inquired about their specialty, was examined, it was observed that general dentists and endodontists participated more intensively in the survey (Table 1). Gender distribution was homogeneous, with 52.6% female and 47.4% male. Among the trainee participants, 87 were female and 86 were male, while 87 were female and 71 were male among the graduates. Statistically, there is no significant difference between the graduate and trainee groups (Table 1). However, there was no statistically significant difference between the genders of the participants according to the graduate and trainee groups ($p > 0.05$). The sources used for prescribing antibiotics show the increasing use of the internet, although other methods are also frequently used (Graph 1).



Graph 1. Distribution of sources used for prescribing antibiotics

The majority of the participants, 303 people, answered yes to the question, 'Can inappropriate antibiotic use increase antimicrobial resistance? Yes, while the remaining 18 answered no. The majority of the participants, 62.1%, thought that antibiotics were prescribed more than necessary, followed by 19.1% who thought that antibiotics were prescribed as needed, and 18.8% had no idea. When asked which antibiotic you would use as the first choice in the treatment of dentoalveolar abscesses, 86.4% (280 people) answered amoxicillin, 6.8% (22 people) clindamycin, 5.9% (19 people) metronidazole, and the remaining 0.19% (3 people) erythromycin.

When asked, 'In which of the following cases is antibiotic prophylaxis not necessary? ', the vast majority of respondents, 96.6% (317 people), selected the correct answer, 'In the absence of heart defects', while the other answers were: 4% (13 people) congenital heart defects involving abnormal leakage or a shunt between the systemic and pulmonary circulation'; 1.8% (6 people) surgical repair of congenital heart defects (if performed less than 6 months before dental treatment)'; 1.2% (4 people) in patients with artificial heart valves Only 2 people checked in patients with a history of infective endocarditis'. When asked which antibiotics can be prescribed to a breastfeeding patient, only 13.9% of the participants gave the correct answer: "Amoxicillin-clavulanic acid, erythromycin, and cefuroxime axetil". To the question "Which of the following cephalosporins is appropriate to use in a patient with an antibiotic allergy who can use oral medication?", the majority of the participants gave the correct answer "Cephalexin".

When the answers given to the questions about antibiotic use in endodontic treatments, one of the most frequently performed procedures in dentistry, were evaluated, it was observed that the majority of the participants gave the correct answer (Table 2). In the case of congenital heart defects involving abnormal leakage or a shunt between the systemic and pulmonary circulation, 4% (n=13) and 1.8% (n=6) stated that prophylaxis was not necessary in patients with a history of infective endocarditis, 96.6% (n=317) in patients without heart defects, and 1.2% (n=4) in patients with artificial heart valves. When asked which of the following cephalosporins is appropriate to use in a patient with an antibiotic allergy who can use oral medication, 56.2% (n=173) of the participants answered Cephalexin, 4.5% (n=14) Cephalothin, 4.9% (n=15) Cefapirin, 32.8% (n=101) Cefazolin, and 15.9% (n=49) Ceftriaxone. In endodontic infections, 11% (n=36) preferred antibiotics for fistulized chronic apical abscess, 77.3% (n=252) for non-localized infection with widespread distribution in soft tissue, 25.5% (n=83) for localized swelling, 21.2% (n=69) for symptomatic apical periodontitis, and 9.2% (n=30) for symptomatic pulpitis.

Table 2. Distribution of questions related to endodontics

	n (%)
First choice for first-line treatment of dentoalveolar abscesses	
Amoxicillin*	280 (86.4) *
Erythromycin	3 (0.9)
Clindamycin	22 (6.8)
Metronidazole	19 (5.9)
In which cases there is no need for prophylaxis	
Congenital heart defects involving abnormal leakage or a shunt between the systemic and pulmonary circulation.	13 (4.0)
Surgical repair of congenital heart defects (if performed less than 6 months before dental treatment)	6 (1.8)
In patients with a history of infective endocarditis	2 (0.6)
Those without heart defects *	317 (96.6)*
In patients with artificial heart valves	4 (1.2)
Which of the following cephalosporins is appropriate to use in a patient with antibiotic allergy who can use oral medication	
Cephalexin*	173 (56.2)*
Cephalothin	14 (4.5)
Cefapirin	15 (4.9)
Cefazolin	101 (32.8)
Ceftriaxone	49 (15.9)
In which case the patient prefers to use antibiotics in endodontic infections	
Chronic apical abscess with sinus tract	36 (11.0)
Non-localized infection with widespread distribution in soft tissue *	252 (77.3)*
Localized swelling	83 (25.5)
Symptomatic apical periodontitis	69 (21.2)
Symptomatic pulpitis	30 (9.2)
In which of the following should antibiotics be prescribed as supportive therapy after endodontic intervention?	
Chronic apical abscess	42 (13.1)
Chronic apical periodontitis	24 (7.5)
Necrotic pulp	13 (4.0)
Cellulitis*	266 (82.9)*
Symptomatic irreversible pulpitis	40 (12.5)
Which antibiotic would be your most appropriate choice for persistent endodontic infections?	
4th Generation Cephalosporin	28 (8.7)
Empirical antibiotic treatment	15 (4.7)*
Broad-spectrum antibiotics	118 (36.8)
Culture-assisted antibiotic treatment*	149 (46.4)*
Penicillin group	61 (19.0)
I. Amoxicillin II. Beta-lactamase inhibitors III. Doxycycline IV. Clindamycin V. Erythromycin Which or which of the above antibiotics is not suitable for use in pregnancy and lactation?	
I, II and IV	27 (8.6)
I, II and V	19 (6.1)
III and V*	110 (35)*
Only II	34 (10.8)
Only III	124 (39.5)
Which of the following antibiotics is not used in endodontic infections	
Amoxicillin	3 (1.0)
Azithromycin	42 (13.9)
Metronidazole group	38 (12.6)
Penicillin V	35 (11.6)
Rifampicin*	206 (68.2)*
I. Cephalexin II. Cefazolin III. Ceftriaxone IV. Azithromycin V. Doxycycline According to the AHA guidelines for prophylaxis in dental treatment, which or which of the above antibiotics can now be used in patients with penicillin allergy?	
I, II and IV	125 (41.7)
I, II and V	33 (11.0)
I, IV and V*	42 (14.0)*
All	78 (26.0)
None	22 (7.3)
Which is not one of the conditions for which prophylaxis is recommended for the risk of bacterial endocarditis?	
Patients who have had a myocardial infarction within the previous year*	244 (76.5)*
Patients with a history of infective endocarditis	16 (5.0)
Those with heart valve prosthesis	16 (5.0)
Cardiac transplant patients with cardiac valvulopathy	25 (7.8)
Congenital heart disease	52 (16.3)

More than one option is marked. *indicates the correct answer.

In which case antibiotics should be prescribed as supportive treatment after endodontic intervention, 13.1% (n=42) responded to chronic apical abscess, 7.5% (n=24) to chronic apical periodontitis, 4% (n=13) to necrotic pulp, 82.9% (n=266) to cellulitis, and 19% (n=61) to the penicillin group. Which is not one of the conditions for which prophylaxis is recommended to reduce the risk of bacterial endocarditis? To this question, 76.5% (n=244)

of the study participants answered: patients who had myocardial infarction one year ago; 5% (n=16) patients with a history of infective endocarditis; 5% (n=16) patients with a heart valve prosthesis; 7.8% (n=25) heart transplant patients with cardiac valvulopathy; 16.3% (n=52) congenital heart disease. When asked about antibiotics that are not suitable for use in pregnancy and lactation, only 35% (110 respondents) answered correctly, and 39.5% answered "Doxycycline only". According to the most recent AHA (American Heart Association) guidelines for prophylaxis in dental treatment (19), which of the above antibiotics can be used instead of clindamycin, which is no longer recommended for patients with penicillin allergies? When we analyze the answers to the question, we see in **Table 2** that only 42 people (14%) gave the correct answers of Cephalexin, Azithromycin, and Doxycycline.

In **Table 3**, the responses of interns and graduated dentists to general RUA questions are evaluated. The proportion of interns who thought that dentists were over-prescribed in terms of RUA was found to be statistically significantly lower than that of graduates (p=0.001; p 0.01). The rate of the interns' first choice of Clindamycin in the first-line treatment of dentoalveolar abscesses was statistically significantly higher than that of the graduates (p=0.001; p 0.01). Interns had a higher rate of thinking that the use of Cephalexin was appropriate in a patient with an antibiotic allergy who could use oral medication (p=0.001; p 0.01), while the rates of using Cefapirin, Cefazolin, and Ceftriaxone were lower (p=0.042; p=0.009; p=0.039; p 0.05).

In **Table 4**, the evaluation of the questions related to endodontic treatment and antibiotics was compared according to the groups. The preference rate of the interns for antibiotic use in cases of non-localized infection with widespread distribution in soft tissue was statistically significantly lower than that of the graduates (p=0.001; p 0.01). The correct answer to this question was lower than that of the graduates. However, when the other response rates given by the interns are examined (even if there is an incorrect answer), the interns are statistically significantly more likely than graduates to prefer the use of antibiotics in the case of fistulized chronic apical abscess, in the case of symptomatic apical periodontitis, and in the case of symptomatic pulpitis (p=0.001; p 0.01). In which of the following cases should antibiotics be prescribed as supportive treatment after endodontic intervention? In both groups, the correct answer to the question was cellulitis, and no significant difference was observed between the groups. However, the rate of prescribing antibiotics as supportive treatment after endodontic intervention in chronic apical abscess, chronic apical periodontitis, and symptomatic irreversible pulpitis was statistically significantly higher in interns than in graduates (p=0.004; p 0.01).

Table 3. Evaluation of 'rational use of antibiotics related questions by groups

	Group		p
	Trainee dentist	Others	
What he/she thinks about the attitude of dentists regarding RUA			
No opinion	44 (25.4)	18 (11.5)	[c]0.001**
I think it is prescribed more than necessary.	82 (47.4)	123 (78.3)	
I think it is prescribed as needed.	47 (27.2)	16 (10.2)	
First choice for first-line treatment of dentoalveolar abscesses			
Amoxicillin	134 (79.3)	146 (94.2)	[c]0.001**
Erythromycin	2 (1.2)	1 (0.6)	
Clindamycin	19 (11.2)	3 (1.9)	
Metronidazole	14 (8.3)	5 (3.2)	
In which cases is there no need for prophylaxis?			
Congenital heart defects involving abnormal leakage or a shunt between the systemic and pulmonary circulation.	3 (1.8)	10 (6.4)	[a]0.032*
Surgical repair of congenital heart defects	4 (2.3)	2 (1.3)	[b]0.686
In patients with a history of infective endocarditis	1 (0.6)	1 (0.6)	[b]1.000
In those without heart defects	164 (95.9)	153 (97.5)	[a]0.437
In patients with artificial heart valves	3 (1.8)	1 (0.6)	[b]0.357
Which of the following cephalosporins is appropriate to use in a patient with antibiotic allergy who can use oral medication			
Cefalexin	111 (68.9)	62 (42.2)	[a]0.001**
Cephalothin	4 (2.5)	10 (6.8)	[a]0.069
Cefapirin	4 (2.5)	11 (7.5)	[a]0.042*
Cefazolin	42 (26.1)	59 (40.1)	[a]0.009**
Ceftriaxone	19 (11.8)	30 (20.4)	[a]0.039*

aPearson Chi-Square Test, bFisher's Exact Test, cFisher Freeman Halton Test, *p<0,05, **p<0,01

According to the most recent AHA (American Heart Association) guidelines for prophylaxis in dental treatment, which of the above antibiotics can be used instead of clindamycin, which is no longer recommended? The question was mostly answered incorrectly in both groups. There was no statistically significant relationship between the answers in both groups. To the question "Which or which of the antibiotics is not used in endodontic infections?" both groups gave the correct answer in the majority. Trainees were statistically significantly less likely than graduates not to use the antibiotic Rifampicin in endodontic infections (p=0.026; p 0.05). According to the groups, the most appropriate antibiotic selection of the participants in persistent endodontic infections did not show a statistically significant difference (p > 0.05).

Table 4. Evaluation of 'endodontic treatment and antibiotic' related questions by groups

	Profession		p
	Trainee Dentist	Graduate	
In which case the dentist prefers to use antibiotics in endodontic infections			
Chronic apical abscess with a sinus tract	29 (16,9)	7 (4,5)	[a]0,001**
Non-localized, widespread soft tissue infection^	119 (69,2)	133 (86,4)	[a]0,001**
Localized swelling	48 (27,9)	35 (22,7)	[a]0,284
Symptomatic apical periodontitis	50 (29,1)	19 (12,3)	[a]0,001**
Symptomatic pulpitis	23 (13,4)	7 (4,5)	[a]0,006**
In which of the following cases should antibiotics be prescribed as supportive treatment after endodontic intervention?			
Chronic apical abscess	31 (18,2)	11 (7,3)	[a]0,004**
Chronic apical periodontitis	19 (11,2)	5 (3,3)	[b]0,010*
Necrotic pulp	4 (2,4)	9 (6,0)	[b]0,155
Cellulitis^	137 (80,6)	129 (85,4)	[a]0,250
Symptomatic irreversible pulpitis	30 (17,6)	10 (6,6)	[a]0,003**
Which antibiotic would be your most appropriate choice for persistent endodontic infections?			
4th Generation Cephalosporin	18 (10,8)	10 (6,5)	[b]0,235
Empirical antibiotic treatment	11 (6,6)	4 (2,6)	[b]0,114
Broad-spectrum antibiotic	57 (34,1)	61 (39,6)	[a]0,309
Culture-assisted antibiotic therapy^	74 (44,3)	75 (48,7)	[a]0,431
Penicillin group	32 (19,2)	29 (18,8)	[a]0,940
Which of the following antibiotics is not used in endodontic infections?			
Amoxicillin	1 (0,6)	2 (1,4)	[b]0,607
Azithromycin	12 (7,6)	30 (20,8)	[a]0,001**
Metronidazole group	18 (11,4)	20 (13,9)	[a]0,603
Penicillin V	18 (11,4)	17 (11,8)	[a]1,000
Rifampicin^	117 (74,1)	89 (61,8)	[a]0,026*
I. Cephalexin II. Cefazolin III. Ceftriaxone IV. Azithromycin V. Doxycycline According to the AHA (American Heart Association) guidelines for prophylaxis in dental treatment, which or which of the above antibiotics can be used for patients with penicillin allergy?			
I, II and IV	67 (43,2)	58 (40)	[c]0,872
I, II and V	19 (12,3)	14 (9,7)	
I, IV and V^	21 (13,5)	21 (14,5)	
All	37 (23,9)	41 (28,3)	
None	11 (7,1)	11 (7,6)	
Which is not one of the conditions for which prophylaxis is recommended for the risk of bacterial endocarditis?			
Patients who had a myocardial infarction one year ago^	123 (74,5)	121 (78,6)	[a]0,397
Patient with a history of infective endocarditis	11 (6,7)	5 (3,2)	[b]0,203
Heart valve prosthesis	8 (4,8)	8 (5,2)	[b]1,000
Heart transplant patients with cardiac valvulopathy	19 (11,5)	6 (3,9)	[b]0,012*
Congenital heart disease	17 (10,3)	35 (22,7)	[a]0,003**

aPearson Chi-Square Test, bFisher's Exact Test, cFisher Freeman Halton Test, *p<0,05, **p<0,01, ^ Indicates the correct answer.

There was no statistically significant difference (p > 0.05) between the groups in which antibiotics the participants used instead of clindamycin, which is no longer recommended for patients with penicillin allergies according to the most recent AHA (American Heart Association) guidelines for prophylaxis in dental treatment. In both groups, the wrong answer was mostly marked. It can be said that physicians have deficiencies in following current information. Which is not one of the situations in which prophylaxis is recommended in terms of bacterial endocarditis risk? Both groups gave mostly correct answers to the question. However, the rate of trainees not considering heart transplantation patients with cardiac valvulopathy as a recommended condition for prophylaxis in terms of bacterial endocarditis risk was statistically significantly higher than that of graduates (p=0.012; p 0.05).

The rate of graduates who did not consider congenital heart disease as a condition for which prophylaxis is recommended in terms of bacterial endocarditis risk was statistically significantly higher than that of interns (p=0.003; p 0.01). According to the groups, there was no statistically significant difference in the rate of participants not considering patients who had myocardial infarction one year ago, patients with a history of infective endocarditis, and patients with heart valve prostheses as recommended prophylaxis in terms of bacterial endocarditis risk (p > 0.05).

DISCUSSION

Today, IUA has become quite common. Various activities aimed at limiting and correcting the misuse of this extremely valuable group of drugs are becoming more important. The prescribing physician group has a very important role not only in the emergence and spread of antibiotic resistance but also in its prevention. Therefore, physicians' knowledge of the rational and appropriate use of antibiotics is very important in the fight against microbial resistance. A prescription is an official document that carries the physician's information and signature and imposes legal liability on physicians. According to Turkish legislation, physicians, dentists, and veterinarians are authorized to write prescriptions. Authorization also means liability. Problems that may arise as a result of the negligence or fault of the physician are also the responsibility of the physician. For this reason, the main goal of physicians when prescribing should be rational treatment, i.e., choosing appropriate, safe, effective, and inexpensive medicines and keeping in mind the principles of evidence-based medicine (carefully examining the data related to the disease and the patient and making the treatment plan accordingly). Various studies have shown that 8% to 10% of all first-line prescriptions are written by dentists.[11,20] Some studies have shown that not only physicians but also dentists overprescribe antibiotics. For example, a survey in the

USA showed that 70% of dentists prescribed inappropriate antibiotics prophylactically before dental procedures.[21] A similar study conducted among general practitioner dentists in the UK showed that only 19% of dentists prescribed appropriate antibiotics as specified in the guidelines.[22] Trainee dentists receive extensive information on rational antibiotic use in their university courses as part of their education. After graduation, they improve their knowledge through the trainings of the Ministry of Health, professional chambers, scientific publications, and various media, such as the internet. This information is of utmost importance for their dental procedures to be more accurate and precise. For this reason, our questionnaire distributed to trainees and graduates included both general information and information on RUA.

It was observed that the respondents generally gave satisfactory answers and were generally well educated. When asked whether inappropriate antibiotic use would increase antibiotic resistance, the majority (91.8%) answered correctly that it would. In our study, graduating physicians and dental students understood that antibiotic resistance is an important problem and that dentists prescribe more antibiotics than necessary for viral infections. This view was also expressed by physicians and the public in other studies.[23,24] Not all conditions associated with an infection in dentistry require antibiotic treatment. Antibiotics do not need to be used in routine dental procedures such as pulpitis, fillings, root canal treatment, apical periodontitis, and drainage of localized dentoalveolar abscesses without systemic symptoms, which do not show signs of systemic involvement, such as fever, malaise, chills, and spread to surrounding tissues such as trismus or cellulitis. Unfortunately, dentists still prescribe antibiotics before treatment, even in these cases.[25] The first step in the treatment of a dentoalveolar abscess should often include surgical debridement, and an antibiotic is only given when medically necessary and general symptoms are apparent.[26] When asked which antibiotic would be preferred, when necessary, the majority of dentists and students (86.4%-280 people) gave the correct answer of amoxicillin. It was observed that the results overlapped with another study conducted on this subject.[27] However, clindamycin was the first choice in a study conducted in Poland.[28] Attention should be paid to safe antibiotic use in breastfeeding or pregnant patients. It was observed that the level of knowledge of the respondents on this subject was insufficient (13.9% correct answer) and needed to be improved with education. Appropriate treatment for a patient allergic to 'penicillin', which is usually one of the first-line drugs in dentistry, was also addressed in our study. In 2021, after the American Heart Association published an update on the prevention of infective endocarditis caused by viridans group streptococci, the prophylaxis guideline for dental treatments was also updated. Accordingly, clindamycin is no longer recommended in patients with penicillin allergies.[19] According to this publication, the use of cephalexin, azithromycin, clarithromycin, or doxycycline is recommended in cases of oral drug intake in patients with penicillin allergy, and cefazolin or ceftriaxone is recommended in cases of non-oral drug intake. Current dental prophylaxis knowledge was also questioned in our study.

Only 7.7% of the respondents gave the correct answer. Thus, in addition to revealing the lack of physicians following the current literature, the importance of following the current literature has once again emerged. In a study, the knowledge, and behaviors of parents of patients admitted to the pediatric outpatient clinic on antibiotic use were measured. While the rate of antibiotic initiation without visiting a doctor was found to be lower in fathers (31.8%) than in mothers (42.9%), the rate of antibiotic initiation without visiting a doctor was found to be statistically significantly higher in those with 8 years of education than in those with >8 years of education.[29] There is a need to increase the level of knowledge and awareness with educational programs on this subject.

In a study conducted in India in 2017, the knowledge levels and practices of trainee and graduate dentists in prescribing antibiotics and analgesics were compared. In the study with 870 participants, it was shown that the knowledge level of trainee dentists was lower than that of graduate dentists.[30] In our study, 94.2% of the graduate dentists and 79.3% of the trainee dentists gave the correct answer "amoxicillin" to the question of which antibiotic you would prefer in the first-line treatment of dentoalveolar abscesses. There is a statistically significant (p=0.001) difference between them. In line with the study of Doshi et al.[30] and in a way that can be explained by professional experience, the knowledge level of the trainee dentists was lower than that of the graduate dentists (**Table 3**). Again, in our study, 86.4% of the graduate dentists and 69.2% of the trainee dentists marked the correct answer "non-localized infection with widespread distribution in soft tissues" when asked which antibiotic should be used in endodontic infections. There was a statistically significant difference between them (p=0.001).

CONCLUSION

According to the results of our study, dentists play a major role in ensuring rational antibiotic use. In the study, the general situation of the trainees who are still learning to treat with new information and the experienced graduate dentists on antibiotic use was evaluated. We can say that graduates and interns do not differ significantly on this important issue. We can say that dentists should be regularly trained with updated curricula after graduation.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Van Yüzüncüyıl University Clinical Researches Ethics Committee (Date: 01.09.2022, Decision No: 01).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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